**Send In the Clones**

Would a clone of yourself actually be you? People might tell you that you have your mother's eyes or your father's smile, or that your sister looks just like you did at her age. Why is that? You know that you are different in some ways from everyone in your family, but the fact remains that children look like their parents, just like you look like yours.

Children look like their parents because they share \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The genetic material of a cell is called deoxyribonucleic acid, DNA for short. The genetic material of a cell acts as a blueprint for what we look like. Half of your DNA is from your mother and the other half is from your father. You have your mother's eyes because you have those genes, specific units of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, from her that control eye color and shape.

Those \_\_\_\_\_\_\_\_\_\_\_\_\_ came to you when your mother's \_\_\_\_\_\_\_\_\_\_ fused with your father's \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Egg and sperm are specialized cells for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. These cells are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Gametes only contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of the amount of DNA a cell must have to live. This is because they eventually come together and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_their DNA. The process of egg and sperm joining is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

These cells only exist in special parts of the body used for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The rest of your body is made up of cells that have the entire DNA they must have to live. Those cells that are found outside the reproductive organs are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells. This word is easy to remember if you know that soma means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in another language.

**Natural Clones**

When an egg is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with a sperm and the DNA mixes, the cell starts \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Dividing cells is the way we grow from one cell to many \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells, which is what you are right now. Sometimes, the dividing mass of cells \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Spontaneously!) into two masses of cells. Both masses keep dividing. The cells all have the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DNA. The two eventually grow into two kids with the same DNA. They are then known as identical twins.

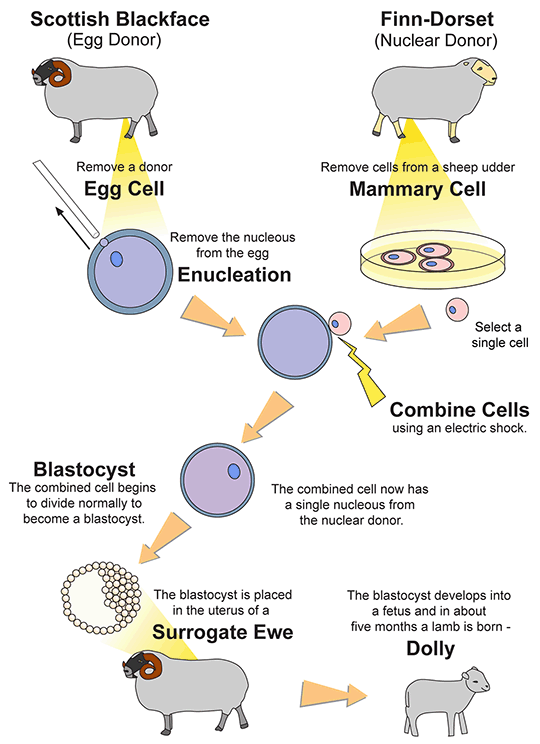
These kids have the exact \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DNA, which is exactly what a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is. Yes, we already have human clones walking among us! Amazing right? Perhaps you know some identical twins? If you do, you might know that they might look the same, but they are very unique people in many ways. That is why a clone of you might not be you at all in the end. They might just be a separate, unique and beautiful person, like you, but different.

**The Story of Dolly**

Dolly is the name of a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that has the honor of being the first mammal to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by a group of scientists in Scotland. Dolly was born July 5th, 1996 and she passed away in 2003. She lived for \_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_years, as a normal, active ewe. She was not that normal though, she was a clone after all.

There are several breeds of sheep in the world. The sheep we focus on here are easy to remember though. One breed of sheep is the Scottish Blackface and the other is a Finn Dorset. What is easy about those names is that the Blackface actually has a black face. The Finn Dorset is all white. You know that the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in our cells determines how we look on the outside. The black face of the Blackface sheep is determined by its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material, which means you can check to see who has that genetic material by just looking at their face! Very easy!

**How Dolly Was Made**

[](https://askabiologist.asu.edu/sites/default/files/resources/articles/cloning/Dolly-clone-sheep-1024.gif)

In Dolly's case, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of an egg from a black faced sheep was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The nucleus from a white faced sheep was\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into that egg. Now, they had just \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell with the nucleus of a white faced sheep, but the rest of the cell containing items from a black faced sheep. That cell was placed into the black faced sheep who's egg it started out as. The cell eventually grew up and made Dolly. When Dolly was born, her face was white!

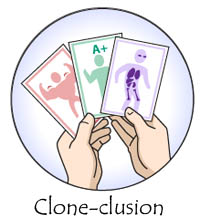
Black faced sheep never have white faced sheep. Dolly's face being white was good \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that the experiment was successful, but scientists double checked Dolly's genetic material. They found that Dolly \_\_\_\_\_\_\_\_\_\_\_\_\_ have the exact same genetic material as the white faced sheep that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Dolly did not have any genetic material from the black faced sheep who was her \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

*Scottish embryologist, Iam Wilmut, feeding his cloned sheep Dolly. The first mammal to be cloned.*

The story was first published as a short report in a scientific journal called Nature, Volume 385, 1997, pages 810-812. Since that time, attempts at cloning at least \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species of mammals have been made. Only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_attempts have been successful; cows, sheep, goats, mice, pigs, cats, and rabbits. The rate of success is very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Several questions are brought up by Dolly's life and death. Scientists were interested to see if she \_\_\_\_\_\_\_\_\_\_\_\_\_faster because the genetic material was \_\_\_\_\_\_\_\_\_\_\_\_\_\_ than that from a fertilized egg. It was thought that she was aging faster, but no one could be sure. Dolly's cells looked a little older in a region in the genetic material, but is that enough to cause premature aging? Dolly got \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ , a disease that mainly affects older individuals, but again, no one could be sure if it was because she was a clone. Some animals get arthritis early in life. Dolly even gave birth to a daughter, who was completely normal in all ways. Dolly led an active, healthy, sheep life until she passed away.

Dolly got \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sick with a lung infection that affects many sheep. Scientists decided to put her down, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ her, to end her suffering. Dolly passed away when she was six and a half years old. That is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the average lifespan for a Finn Dorset sheep. She is now stuffed and on display in Edinborough, Scotland. We learned a lot from Dolly while she was alive and when she had passed away, but she might have left many more questions than answers.

**Clone-clusion**

There are several \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that are brought up by cloning. The logical conclusion to most research done with cloning is the question of cloning people. Cloning of people is currently \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the United States and many other countries. There are two main applications of cloning that bring up serious \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ questions.

The first main application of cloning is that the technology can be used to create "\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ children." The ability to \_\_\_\_\_\_\_\_\_\_\_\_\_ specific genetic material you want to and make a child means that people could \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ make their children. This worries people because of the possible use of the technology to make children to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ another person from an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or to make another person to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ organs from, or to take the genetic material of a great athlete. The question is: does the designed child have a right to lead life without the burden of the original purpose they were created for?

What do you think and why?

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The second main application of cloning is that the technology can be used to create "\_\_\_\_\_\_\_\_\_\_\_\_ cells." Stem cells are cells that have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ decided what they are to become. Stem cells can theoretically become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This makes stem cells important in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ treatment. Stem cells are extracted from an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. A fertilized \_\_\_\_\_\_\_\_\_\_\_\_ will create an embryo. An egg that has had its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ removed and replaced by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ cell will create an embryo. This act of removing stem cells, \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the embryo from living. Using the nuclear transfer method will create a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ embryo. This designer embryo will have the same cell type as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ nucleus. The question is: will people start making designer embryos to create stem cells that might save them from disease years from now?

What do you think and why?

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Of course, there are many other issues within \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ here. You might know of several. The way to answer these \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ issues is through discussion, education, and scientific research. That means you need to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ with people, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at school, and maybe even become a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ yourself!

The word ‘somatic’ comes from the Latin word for what?

1. Cell
2. Clone
3. Body
4. Blood
5. Stomach

Gamete means:

1. Body cell
2. Cloned cell
3. Reproductive cell
4. Skin cell
5. Gamatic cell

How did they determine that dolly was in fact a **clone**?

1. She had a white face
2. She had a black face
3. She was identical to her birth mother
4. Her genetic material was tested to confirm

What is an example of an **ethical** question?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What does the term **embryo** mean? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are designer children?

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What are the applications of stem cells?

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We are now going to watch **Netflix Explained – Designer DNA**

Fill out this KWL (know, want to know, learned) chart as we watch. Feel free to draw images, write key words, question things being talked about etc.

|  |  |  |
| --- | --- | --- |
| **Know** | **Want to Know** | **Learned** |
|  |  |  |